



## RECYCLING SYSTEM OF AQUEOUS PAINT

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JUL 24 2003  
TC 1700

### FIELD OF THE INVENTION

5 [0001] The present invention relates to a recycling system for ~~of~~ aqueous paints in which plural aqueous paints having different paint colors can be used, and which contains ~~apparatuses~~ apparatus or ~~equipments~~ equipment required for an operation, between a collection of an excess paint from after coating an article and ~~reusing~~ reuse of the collected paint.

### BACKGROUND OF THE INVENTION

10 [0002] An aqueous paint has widely been used for coating industrial products. An aqueous paint is especially noted from ~~the a~~ point of re-use ~~of resource~~ without paint waste, because over-sprayed paint, i.e. aqueous paint that does not adhere ~~with to~~ to an article ~~to be coated~~ during coating is collected with water, filtered and concentrated, followed by ~~re-using~~ re-use it as paint. The paint also tends to be more widely used ~~by the reasons that~~ because a filtrate of the paint  
15 is water, and ~~that therefore~~ the paint is easily handled without exhibiting any problem, such as air pollution, in comparison with ~~one a~~ a paint using organic solvent.

[0003] A recycling system ~~of for~~ an aqueous paint currently used is shown in Figure 2. In Figure 2, an article ~~to be coated~~ 301 is coated with an aqueous paint sprayed from a coating-gun 302 in a water-curtain-type coating booth 300. Over-sprayed paint 304 is collected by water-curtain 303, and sent as diluted paint to a concentration tank 305. ~~The paint~~ Paint in the  
20 concentration tank 305 is filtered by a filtration equipment, usually ultrafiltration equipment 307, to separate it into a concentrated paint and a filtrate. The concentrated paint is then returned to the concentration tank 305 and the filtrate 309 is sent to a filtrate bath 308. When ~~the~~ concentrated paint 306 stored in the concentration tank 305 is used, it is moved to a concentrated paint tank 310, stored and re-prepared therein, followed by ~~transferring~~ being transferred from the concentrated paint tank 310 to the coating-gun 302 to coat an object. The filtrate 309 is stored in the filtrate bath 308 and, if necessary, used as the water-curtain 303 or a solution for washing.  
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[0004] The above recycling system of aqueous paint is designed for coating ~~one color~~ aqueous paint of one color, and is not considered for use when changing one paint color to another paint color, or using aqueous paints having different paint ~~color~~ colors, in the same recycling system. In ~~the a~~ case where two or more different ~~color~~ colored paints are used, it is considered that ~~the same~~ recycling systems as shown in Figure 2 are required to be used in number equal to the number of paint colors, but this is unrealistic because a space for ~~equipments~~ equipment increases.

[0005] In order to change aqueous paints having different paint colors in the same recycling system, an aqueous paint which has been coated onto an object has to be completely removed from the recycling system and sufficiently washed, after which another aqueous paint having a different ~~paint~~ color is applied thereto. However, a large amount of waste solution is created by washing.

[0006] It is also required that ~~the~~ aqueous paint that has been previously ~~been~~ coated onto an object is collected by the recycling system and concentrated to be temporarily ~~store~~ stored as a concentrated paint. If a number of paint ~~color~~ colors of aqueous paints used in a recycling system increases, spaces for storing ~~the~~ concentrated paints are required corresponding to the number of paint ~~color~~ colors, which does not comply with the present situation in which an aqueous paint is more widely used.

## OBJECT OF THE INVENTION

[0007] The present invention provides systems and processes solving the problems mentioned above, in which, when two or more aqueous paints having different paint colors are coated object(s) using one recycling system for a single aqueous paint, the aqueous paints are classified into ~~some~~ groups and are collected, separated and concentrated based on each group, so as to decrease ~~number~~ an amount of ~~equipments~~ equipment and the like required for ~~the~~ operations operation.

## SUMMARY OF THE INVENTION

[0008] That is, the present invention provides with a recycling system ~~of~~ for an aqueous paint ~~comprising; that is for:~~

coating onto an object an aqueous paint, having a paint color that is toned with two or more original color aqueous paints, in a water-curtain-type coating ~~booth;~~ booth;

collecting an over-spray paint, that does not adhere ~~with an article to be coated to the~~ object, in a booth circulation water ~~bath;~~ bath;

separating and concentrating the over-spray paint by ultrafiltration equipment to store as a concentrated paint in a concentration ~~bath;~~ bath; and

~~taking out~~ removing the concentrated paint from the concentration bath when it is used, and toning its color ~~to reuse;~~ for reuse;

wherein, when two or more aqueous ~~paint~~ paints having different paint colors are coated onto object(s) in the recycling system, the over-spray paints are collected based on their group ~~by group~~ according to a classification based on identity of combinations of pigments contained in the aqueous paints, and separated and concentrated to be stored ~~store~~, so as to provide the recycling system with a smaller number of booth circulation water baths, ultrafiltration ~~equipments~~ equipment, concentration baths and filtration baths than there are paint colors of aqueous paints.

[0009] In the recycling system of the present invention, the concentrated paint can be toned using ~~a~~ computer-color-matching equipment ~~to~~ for reuse.

[0010] The present invention also provides with a process for reusing an aqueous paint, ~~comprising;~~ comprising:

coating onto an object an aqueous paint having a paint color that is toned with two or more original color aqueous paints, in a water-curtain-type coating ~~booth;~~ booth;

collecting an over-spray paint, that does not adhere ~~with an article to be coated to the~~ object in a booth circulation water ~~bath;~~ bath;

separating and concentrating the over-spray paint by ultrafiltration equipment to store as a concentrated paint in a concentration ~~bath;~~ bath; and

~~taking out~~ removing the concentrated paint from the concentration bath when it is used, and toning its color to reuse; for reuse.

wherein, when two or more aqueous paints having different paint colors are coated onto object(s) in the recycling system, the over-spray paints are collected based on their group by group according to a classification based on identity of combinations of pigments contained in the aqueous paints, and eparated and concentrated to be store stored.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

[0011] Figure 1 is a schematic view that shows a recycling system ~~of for~~ for an aqueous paint according to the present invention.

[0012] Figure 2 is a schematic view that shows a conventional recycling system ~~of for~~ for an aqueous paint.

## **DETAILED DESCRIPTION OF THE INVENTION PREFERRED EMBODIMENTS**

[0013] A paint color of an aqueous paint used in ~~the a~~ a recycling system of the present invention is generally obtained by mixing original color aqueous paints to tone to a desired paint color. ~~The representative~~ Representative original color aqueous ~~paint includes paints include~~ aqueous paints having paints of six colors ~~of~~, for example, white, black, green, red, yellow and blue, but the present invention is not limited to ~~them~~ these colors.

[0014] Conventionally, toning has been carried out by properly mixing these original color aqueous paints from experience or by a suitable machine, but lately, it such toning is automatically carried out by a so-called Computer Color Matching System (usually abbreviated to CCM) which has recently been developed.

[0015] When toning of paint is carried out by the CCM system, each original color paint is previously coated on a test piece to form a coated piece having a coating, on which a spectral reflection factor is measured. ~~The result-inputs~~ measured spectral reflection factor is input to a CCM program and ~~calculates~~ calculations are performed to obtain data of each original color (absorption coefficient and scattering coefficient). For an aqueous paint having a desired paint color, a coated piece is similarly formed and a spectral reflection factor is measured on ~~the a~~ a

surface of the coating. In the CCM system, a formulating amount of each original color paint is calculated by a calculation program and an error correcting program (such as error of the theory of mixing colors, error of making data of original colors, error caused by changing coloring abilities of original colors which are used, and the like) based on calculated data of each original color and a spectral reflection factor of the a desired paint color which is input. A formulating amount of each original color paint is then respectively calculated by an automatic computer equipped in a the CCM system respectively, and suitable amounts of original color paints are mixed to obtain an aqueous paint having a desired paint color.

[0016] ~~The introduction~~ Introduction of the CCM system decreases ~~number of using an amount of an original color paint used~~ in comparison with a conventional method in which toning is carried out based on visual evaluation by a person, ~~and~~ The CCM system also ~~allowed to allows for automatic measuring of automatically measure~~ formulating amounts, so as to reduce difference of qualities between aqueous paints which are toned.

[0017] In the present invention, it is premised that an aqueous paint is toned to a desired paint color by a CCM system as mentioned above, but in some ~~case~~ cases, an aqueous paint can be toned without the CCM system and toned by a conventionally known experimental method in which a desired color is visually compared with a paint color of a paint obtained by properly mixing original color aqueous paints.

[0018] Details of the present invention will be explained with reference to Figure 1 hereinafter. Figure 1 is a schematic view that shows a specific example of the a recycling system of aqueous paints according to the present invention.

[0019] The recycling system of an aqueous ~~paint~~ paints of the present invention basically is composed of ~~5~~ five work areas ~~of including~~: (1) spray coating of an aqueous ~~paint~~; paint; (2) collection, separation and concentration of an over-spray paint after ~~coating~~; coating; (3) storage of a filtrate and a concentrated paint that are ~~separated~~; separated; (4) preparation of a concentrated paint; and (5) recycling of the concentrated paint that is prepared.

(1) Spray coating of an aqueous paint

[0020] Into the recycling system of the present invention shown in Figure 1, a CCM system 10 is incorporated. An aqueous paint used in the recycling system may be prepared by automatically toning by the CCM system 10 in the recycling system, or may be separately prepared from the recycling system, using same original paints which are used in the CCM system 10 in the recycling system.

[0021] Now, in order to simplify the explanation of the present invention, aqueous paints of six colors ~~are~~ coated onto objects in the recycling system will be explained. This is mere exemplification to make the explanation easy and is not construed as limiting paint colors of aqueous paints used in the present invention to six colors.

[0022] In Figure 1, a sort of aqueous paint selected from aqueous paints 101 to 106 having six different paint colors (a, a', a", b, b' and b") is spray-coated to onto an article 11 ~~to be coated~~ by a coating gun 2 in a coating booth 1. Among the six paint colors, a, a' and a" are obtained from combinations of same original color paints, ~~of and~~ b, b' and b" are also obtained from combinations of same original color paints, but which are different from the original color paints of the "a " group, as mentioned later.

(2) and (3) Collection, separation, concentration and storage of paint

[0023] In the recycling system of the present invention, aqueous paints are classified into several groups based on identity of combinations of pigments contained therein, and collection, separation, concentration and storage are carried out for every group after coating of the article 11. That is, two or more aqueous paints having different paint colors are classified such that the aqueous paints having the same combination of pigments contained in aqueous paints belong to the same group. In the present invention, the classification of aqueous paints depends on only the a combination of pigments and does not depend on density and formulating ratio of pigments.

[0024] In the term of " same pigment", a level of sameness may be critical, but in the present invention, pigments having same Color Index No. are regarded as the same pigments. That is, what aqueous paints ~~have~~ having the same combination of pigments contained therein means is that paints have a combination of pigments having the same Color Index No.,

respectively. For example, when aqueous paints having three different paint colors are used as follow follows:

Aqueous aqueous paint A having a combination of two sorts of pigments of Color Index No.X and Color Index No.Y;

5        Aqueous aqueous paint B having a combination of two sorts of pigments of Color Index No.X and Color Index No.Y; and

Aqueous aqueous paint C having a combination of three sorts of pigments of Color Index No.X, Color Index No.Y and Color Index No.Z;

the paints A and B belong to the same group and the paint C belongs to another group.

10        [0025]        For example, Figure 1 shows that aqueous paints 101 to 106 having six different paint colors (a, a', a", b, b' and b") are spray-coated onto a object using the same coating booth 1. For example, among aqueous paints 101 to 106, when three sorts of aqueous paints 101 to 103 have paint colors of a, a', and a" which are respectively obtained by using combinations of three original color paints having including white, black and yellow to tone, they these aqueous  
15        paints belong to group A in Figure 1. When three sorts of aqueous paints 104 to 106 have paint colors of b, b', and b" which are obtained by using combinations of four original color paints having including white, red, yellow and black to tone respectively, they these aqueous paints belong to group B in Figure 1. Thus, aqueous paints having six paint colors can be used in the recycling system to be separated separate into two concentrated paints.

20        [0026]        In the recycling system of the present invention, continuous operation of coating, collection and storage can be carried out using the same apparatus or equipment as long as an aqueous paint to be used belongs to same group, even if it shows a different color tone. For example, in Figure 1, three sorts of aqueous paints 101 to 103 having paint colors of a, a', and a" that belong to group A are used continuously, and three sorts of aqueous paints 104 to 106  
25        having paint colors of b, b', and b" that belong to group B are also used continuously even if though they have different paint color colors.

[0027]        However, as shown in Figure 1, aqueous paints that belong to group A and group B are respectively collected, separated and , concentrated to-store and stored using different apparatuses apparatus or equipments equipment from each other, i.e. the apparatuses apparatus

or equipments equipment shown as Equipment Group A or Equipment Group B in Figure 1. Thus, as shown in, for example, Figure 1, the present invention allows a for space required for ~~apparatuses~~ apparatus or ~~equipments~~ equipment, with the exception of the space required for coating booth 1, to be greatly ~~decrease a space required for equipment groups from six~~ decreased to two (an area owned by Equipment Group A and Equipment Group B), even if aqueous paints having six different paint colors are used.

[0028] First, it will be explained that how aqueous paints 101 to 103 that belong to Group A having paint colors of a, a' and a" are used in the recycling system in Figure 1.

[0029] ~~In the above paragraph (2), when~~ When any paint selected in from aqueous paints 101 to 103 is spray-coated in the coating booth 1, an over-spray paint 4 that does not adhere with to the article 11 ~~to be coated~~ is collected by water curtain 3, made of which is formed from booth circulation water. In the booth circulation water, a hydrophilic solvent that is generally used for aqueous paint may be contained ~~therein~~ in order to stably disperse the over-spray paint into water.

[0030] A solution that contains the over-spray paint 4 collected by the booth circulation water is called paint diluent 17 herein.

[0031] The paint diluent 17 is collected and then stored in a booth circulation water bath 15 in Equipment Group A, ~~followed by sending and is then conveyed~~ to a concentration bath 16. The paint diluent 17 in the concentration bath 16 is processed by ~~an~~ ultrafiltration equipment 18 several times to concentrate the paint diluent, thus obtaining a concentrated paint 20 in the concentration bath 16. The concentrated paint 20 is ~~sent~~ conveyed to a concentrated paint bath 19 to store the concentrated paint. At the same time, a filtrate 22 filtered by the ultrafiltration equipment 18 is collected and ~~sent~~ conveyed to a filtrate bath 21 to store the filtrate.

(4) To (5) Preparation of a concentrated paint and reusing it the concentrated paint

[0032] The concentrated paint 20 that is obtained from the aqueous paint belonging to Group A and is stored, is ~~taken out~~ removed from the concentrated paint bath 19 when necessary, and color-toned using CCM system 10 so as to reuse this paint.



[0033] Before the concentrated paint 20 is used as an aqueous paint, it is coated ~~on~~ onto a test piece, and is subjected to measurement of a spectral reflection factor ~~on the coated surface~~. The A result of measurement of the spectral reflection factor is inputted ~~inputs~~ into a CCM system 10, and if necessary, a formulating amount of each original color paint is re-  
5 calculated and automatically toned, so as to easily prepare an aqueous paint having a desired paint color.

[0034] In the recycling system of the present invention, the use of the CCM system 10 remarkably decreases ~~number of use~~ an amount of an original color paint used for toning. When an automatic amount measuring instrument is equipped in the CCM system, ~~the~~ automatic  
10 measurement of an amount significantly ~~reduce~~ reduces difference of in qualities between aqueous paints which are toned.

[0035] On the other hand, when aqueous paints 104 to 106 that belong to Group B having paint colors of b, b' and b" are used, ~~the operation work~~ work areas (3) to (5) regarding collection and ~~reusing~~ reuse of paint, are used ~~is carried out as~~ generally as described in for  
15 aqueous paints 101 to 103 that belong to Group A, with the exception that a booth circulation water bath 25, a concentration bath 26, ~~an~~ ultrafiltration equipment 28, a concentrated paint bath 29 and a filtration bath 31 are used.

[0036] In the present invention, aqueous paints that belong to the same group may be used to continuously ~~carry out~~ perform operations of coating, storage and ~~reusing~~ reuse of this  
20 paint without washing a coating booth even if the aqueous paints have different paint colors. However, when two or more aqueous paints belonging to different groups are used for coating and a color change ~~color~~ has to be conducted, an operation must ~~have steps of include~~: stopping coating with an aqueous paint that has been ~~coated~~, coated onto an object; washing the coating booth 1 with a filtrate obtained from a group to which the aqueous paint belongs; ~~to~~ and  
25 changing to an aqueous paint belonging to another group to ~~start~~ begin a coating procedure.

[0037] In the Figure 1, when the aqueous paint 101 having a paint color of "a" that belongs to group A is changed to the aqueous paint 104 having a paint color of "b" that belongs to group B, an operation must ~~have steps of include~~: washing an inner surface of a line, a surface of an inside wall of a coating booth 1, a vent placed in a backside of the coating booth 1, and the

like with a filtrate 22 obtained from the aqueous paint 101 which is used just before change of paint, which is used as water curtain 3; 3; and changing to the aqueous paint 104 to start begin a coating procedure. The filtrate 22 used to wash the coating booth 1 when changing color may be collected and stored in a booth circulation water bath 15. The filtrate 22 can be used when the aqueous paint 101 is being coated onto an article.

[0038] In the present invention, the concentrated paint 20 or 30 is temporarily stored in a concentrated paint bath 19 or 29 until an aqueous paint belonging to the same group of the concentrated paint is newly prepared or toned. This ~~reduce~~ reduces distribution of spectral reflection factors of concentrated paints measured for ~~reusing~~ reuse, and makes it easy to automatically tone with CCM system 10.

[0039] The present invention can be effectively applied to coatings of automobile bodies, steel-made furniture, machines for industry, such as a ~~switchboard~~ switchboards, and parts thereof.

[0040] According to the recycling coating system of aqueous paints of the present invention, since the collection, separation, concentration and further re-preparation of aqueous paints are ~~carried out~~ performed not for every paint color of aqueous paints, but only for every group into which aqueous paints are classified based on identity of combinations of pigments contained in the aqueous ~~paint~~ paints, the number of booth circulation water baths, ultrafiltration ~~equipments~~ equipment, concentration baths and filtration baths can be made ~~smaller~~ to be less than ~~that~~ the number of paint colors of aqueous paints so as to greatly decrease a space required for ~~the apparatuses or the equipments~~ necessary apparatus and equipment. According to the present invention, introduction of a CCM system into the recycling system also allows ~~to~~ for a decrease in an amount of original color aqueous paints used to tone at ~~the~~ a time of ~~reusing~~ reuse.

[0041] A coating booth and the like are washed with a filtrate obtained from an aqueous paint, that is previously used, before an aqueous paint belonging to another group is used, so as to ~~allow~~ increase efficiency of with regard to use of the same coating booth ~~to increase~~, and so as to prevent resins or pigments contained in aqueous paints that have different compositions from relative to each other ~~to be~~ from being mixed.

[0042] A collected and concentrated paint is temporally stored until an aqueous paint belonging to the same group of the concentrated paint is newly toned or re-toned, so that no variation in results of spectral reflection ~~factor~~ factors of concentrated paints measured for ~~reusing would occur~~ reuse occurs and automatic toning by a CCM system ~~could be~~ is easily made performed.